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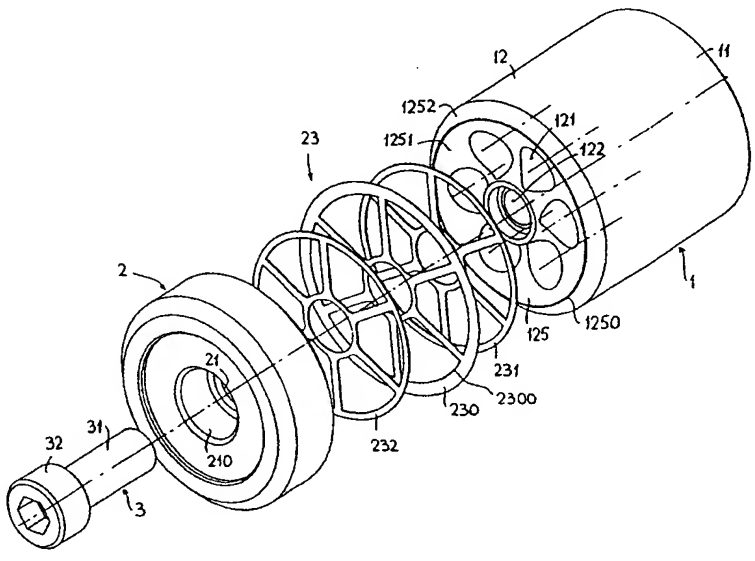
(54) Title: NOZZLE, ESPECIALLY FOR FORMATION OF FOG



(57) Abstract: The aim of the present invention is to conceive a reliably functioning nozzle, which should enable formation of fog, especially of fog consisting of water drops, in amount sufficient also for fire extinguishing, by which the size of water drops incorporated in such fog should be minimized and varied, especially predetermined. The nozzle consists of a housing (1) and a head (2) which are arranged coaxially with respect to each other, as well as of a screw (3) by means of which the head (2) is attached to the said housing (1). Between the said housing (1) and the head (2) which are arranged coaxially and pressed each to another, a cutting means (230) of a primary cutting assembly (23) is inserted, which is also arranged coaxially with respect to the said housing (1) and the head (2).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Nozzle, especially for formation of fog

A present invention relates to a nozzle, which serves for formation of fog i.e. for producing of fog, especially of fog on the basis of water, which can e.g. be used by fire extinguishing.

The aim of the present invention is to conceive a reliable functioning nozzle, which should enable formation of fog, especially fog on the basis of water, in amount sufficient for fire extinguishing, where the size of water drops present in such fog should be as small as possible and preferably adjustable, especially it should be determined in advance, while the fog outflow should also be available in appropriate shape, so that the produced fog could fill the whole available space in front of the nozzle as efficient as possible.

As known from the prior art, efficient fire extinguishing can be achieved by means of fog on the basis of water, which means fog obtained by cutting or dropping a water flow into small water drops. By this, fire extinguishing is possible even in situations, where the fire results from burning of petrol derivatives or other inflammable chemicals or even electric installations together with corresponding appliances. Especially in tunnels, mines or any other similar closed areas, fire extinguishing by means of fog may be very useful, since just localization of fire in such situations may mean a great achievement, enabling after that any further access by any other special extinguishing means, which might be some more efficient in certain situation. In addition it is obvious that the fog is no doubt a fire extinguishing means without any influence with respect to environment pollution.

The fog may be formed by means of a nozzle connected to appropriate means for supplying water under the pressure of several d-bar, less than e.g. one hundred bar. It should be exposed that during formation of fog for the purposes of fire extinguishing, supplying any additional airflow intended for minimizing the water drops, cannot be taken into account at all.

There are various possibilities, which are already known in field of nozzles intended for formation of fog. One of them is widely used, but the source thereof is unfortunately unknown to the applicant; such nozzle comprises a housing, within which a conical cavity is available, and the front/top surface thereof is equipped by a bore of relatively small diameter, namely essentially less than 1 mm. An insert is placed into the said cavity, which diverges from the connecting area, which serves for connection to appropriate pipeline, towards the said bore. Water flow, which enters the interior of the nozzle from the pipeline, is exposed to rotation in the area of the said insert and rotates along its surface, so that by moving towards the said bore by decreasing the diameter its velocity is increasing. When passing the bore the flow is cut or broken to small drops, each having the size e.g. less than 100 μm, if the diameter of the bore is small enough. However, such dimensions of drops are not perfect at all, since even smaller drops are desired by formation of fog. Moreover, the fog is flowing out from the nozzle in form of a cone-like jet, which is relatively narrow. This means that during fire extinguishing, the fog is directed exclusively towards the area in front of a fireman, while the adjacent area, where the fireman is standing, remains outside of any influence of the fog. Assuming, that the attention of the fireman is directed more or less into the target area of the fog flow, it is obvious that the fireman is exposed to serious danger of being jeopardized by fire. On the other hand, such nozzle is bound with serious problems

with respect to reliability during functioning. Just single particle of waste, calc or any other substance which may be present even within the installation for supplying the water for human consumption, can stuff the said bore and block completely functioning the nozzle. It is therefore evident, that especially by fire extinguishing this may be very unpleasant and dangerous, and is of that reason practically unacceptable. Although this nozzle might offer some further benefits due to the fact, that the size of water particles may be adjusted in advance by means of adjusting the water pressure, it is on the contrary still further connected with another great disadvantage, since the allowed water flow is limited to approx. one liter per minute, which is essentially less of any serious quantity as required for efficient fire extinguishing.

A further known construction of a nozzle comprises a housing having cylindrical interior with a widely open conical front surface, on the top of which there is again a bore, i.e. an outlet opening. The nozzle is provided with a needle, which is placed outside of the said housing, however coaxially with the described internal configuration including the said outlet. Again, a water jet is flowing out under the high pressure through the said outlet towards the said needle, where it is cut or broken to small drops and simultaneously deflected into a conical shape. Although in this case preventing any stuffing the nozzle seems to be some easier like by previously described solution, the essential disadvantages remain the same.

Still another nozzle is known, by which the incoming water-flow passes through a bore of relatively small diameter, i.e. a kind of capillary tube. A divergent conical area is available in the outlet area, and a so-called nail is arranged on appropriate distance from the said outlet; by which the said nail is an elongated part having a non-conical and edgeless front area. A thin water jet, which is flowing out of the

said capillary tube, is run onto the front surface of the said nail in order to be cut or broken into the small water drops, by which formation of fog occurs within the said divergent conical area along the said nail. The shape of the obtained fog flow may be very close to the desired one. The flow is namely not conical, but is formed like a paraboloid of revolution, which means that during fire extinguishing the influence of fog may also reach the area adjacent to the nozzle, where the fireman is standing. Unfortunately, extremely small dimensions of the said bore or capillary tube result in limitation of the water flow through the nozzle, ordinary to approx. 6 liters per hour i.e. 0,1 liter per minute, which is not sufficient for fire extinguishing at all. A very similar solution with the same disadvantages is described in PCT/NO94/00214 (WO 95/17926).

Still further nozzle is described in PCT/SE95/00007 (WO 95/18651) and is intended for spreading fog on the basis of water; such nozzle consists of a housing, which serves also for connection to corresponding water supplying installation, and of a nozzle-head, which is inserted coaxially into the said housing. The outlet area of the housing is equipped with a conical surface, which is in contact with a corresponding conical surface of the nozzle-head. On the said conical surface of the nozzle-head several saw-like arranged channels or orifices are arranged, into which the water is lead from the outside of the housing under the pressure of approx 200 bar. Each two adjacent channels converge each towards another, and thanks to the said saw-like arrangement, each two adjacent water jets are directed one towards another. As a consequence of such "crashing" the jets, formation of fog takes place, while the fog is leaving the nozzle in appropriate shaped flow, which is bulked also in radial direction; however, some disadvantages have to be exposed as well. Dimensions of the said channels must obviously be extremely small. It is not a problem to manufacture such channels, but maintaining them with

respect to ensuring functioning the nozzle. Again, the water contains calc, waste, ice and similar particles. On the other side, flowing the water along such small channels is no doubt connected to an essential resistance, through which the pressure of incoming water has to be extremely high. All these features of course also result in several secondary consequences including very expensive appliances required thereto, increasing the risk of various damages, much more comprehensive security measures by handling such appliances, and essential energy consumption required to achieve such pressure.

A nozzle, which is discussed within the scope of the present invention and which is intended especially for forming fog, especially the fog on the basis of water, consists of a housing as well as of a nozzle-head, which are arranged coaxially and adjacent each to another, and whereby the said head is attached to the said housing by means of a screw. The said housing comprises a connecting area, which is intended for connection of the nozzle to the belonging water supply installation and is for this purpose equipped with appropriate thread.

The nozzle according to the invention is characterized by comprising at least one transversally extending cutting means, which is formed like a thin elastic membrane or collar and which belongs to a cutting assembly, which is placed between the housing and the nozzle-head being arranged co-axially each to another and pressed one against to another.

In parallel to the main cutting assembly, the nozzle may also comprise at least one supplemental cutting assembly, by which the cutting means of the supplemental cutting assembly is placed at least essentially in the plane of the cutting means of the main cutting assembly, however outside of the nozzle-head, e.g. in order to

surround this head. It is especially preferable, when the said supplemental cutting assembly comprises at least one supplemental cutting means, which is arranged outside of the nozzle-head and the housing, and which has at least approximately circular shape and is arranged outside of the nozzle-head and the housing at certain distance from the outer surface of the nozzle-head and at least approximately in the plane of the main cutting assembly being available between the housing and the nozzle-head, i.e. transversally with respect to the longitudinal axis of the nozzle. The said supplemental cutting means is held in position by means of positioning means, which protrude in radial direction outwards from the nozzle-head and are preferably available in equidistant arrangement in the circumferential direction.

The main cutting means of the main cutting assembly of the nozzle according to the invention is equipped with a set of openings and/or a set of cutouts of a desired shape, which are arranged in equidistance in the circumferential direction. In one of the possible embodiments, the said cutting means is clamped between at least two positioning means, which are thereby together with the cutting means placed onto the bolt of the screw.

The said housing of the nozzle according to the invention consists of the connecting area and a distributing area, where the connecting area is equipped with a thread, and the distributing area is equipped with a set of holes which are arranged in mutual equidistance in the circumferential direction of the nozzle and extend in the longitudinal direction of the nozzle. The distributing area of the housing is equipped, on the side facing towards the nozzle-head and in the area of the said openings, with a bore intended for inserting the bolt of the screw, and on the opposite side, it is equipped with a centrally arranged convex distributing surface in form of paraboloid. Moreover, the said distributing area of the housing

is equipped with a concave circumferential extending surface, which is arranged in the area of the openings and on which a sharp circumferentially extending edge is available, which is formed by the said surface together with the outer conical surface. In this embodiment, the nozzle-head also comprises a sharp circumferential edge, which is arranged on the side, which faces towards the housing. It is especially preferable, when the nozzle-head, which is equipped by a centrally arranged bore serving for inserting the bolt of the screw, on its side facing towards the housing, is also equipped with a sharp circumferential edge, which is formed by a concave front surface and a conically inclined circumferential surface, and moreover, when the said centrally arranged bore being foreseen for inserting the bolt of the screw, is also equipped with a cavity, which is adapted for receiving a head of the screw. Accordingly, in the most preferable embodiment, the nozzle-head having a centrally arranged bore intended for inserting the bolt of the screw, is equipped on its side facing towards the housing with a sharp circumferential edge, which is formed by a conical inclined outer circumferential surface and a concave front surface consisting of a rounded area arranged adjacent to the bore as well as of a conical area abutting the said rounded area.

In such manner, by the nozzle according to the invention an essential feature may be exposed, that between the edge which is available on the housing, and the edge which is available on the nozzle-head, a cutting assembly is clamped by means of the screw, which extends through the nozzle-head and is screwed into the housing, by which the said cutting assembly consists of at least two positioning means, which are arranged in contact with the belonging edges and between which at least one cutting means is placed, which is relatively thin and formed like a membrane. By one of the possible embodiments, the cutting means of the cutting assembly consists of an inner circular area and an outer circular area, which are mutually

connected by means of a plurality of shanks, which extend in radial direction and are preferably formed in equidistant arrangement in the circumferential direction. By this, each positioning means is preferably formed similar like the cutting means, namely by an inner circular area and an outer circular area, which are mutually connected by means of the set of shanks extending in radial direction.

Forming the fog for the purpose of fire extinguishing may be extremely efficient by using an embodiment of the nozzle, by which between the coaxially arranged and one against another pressed housing and nozzle-head a cutting assembly is clamped, which is arranged coaxially with respect to the said housing and the said nozzle-head, and which comprises at least one at least approximately circular, coaxial and in the transversal plane of the nozzle arranged cutting means, by which the distributing area of the housing is equipped by several longitudinally extending openings which surround a bore adapted for inserting a bolt of the screw, and by which on the front surface of the housing a sharp circumferentially extending edge is available, while the surface facing towards the nozzle-head is sloped in the area of the said openings and forms the said edge together with the outer conical surface, and moreover, the nozzle-head, which is equipped with a bore for inserting a screw and preferably also with a cavity for inserting the head of the screw, on its side faced towards the housing is equipped with a sharp circumferentially extending edge, which is formed by an outer conical inclination and a concave area of the front surface, and in addition, the cutting assembly, which is clamped between the nozzle-head and the housing, comprises at least one cutting means, which is available as a thin elastic membrane and is by means of the said screw clamped between the said sharp edges available on the housing respectively on the nozzle-head.

The nozzle according to the invention will be described in more detail on the basis of embodiments, which are illustrated in the attached drawing, where

Fig. 1 is an explosion view of the first embodiment of the nozzle observed from the inlet side;

Fig. 2 is an explosion view of the first embodiment of the nozzle observed from the outlet side;

Fig. 2 is an explosion view of this first embodiment of the nozzle, by which the most of constituent parts is also shown in a cross-section in the diametrical plane;

Fig. 4 is a perspective view belonging to a further embodiment;

Fig. 5 is a front view belonging to the embodiment according to Fig. 4;

Fig. 6 is a cross-section of a nozzle along the diametrical plane VI - VI according to Fig. 5;

Fig. 7 is a cross-section of a nozzle along the diametrical plane VII - VII according to Fig. 5;

Fig. 8 illustrates one of various possible embodiments of a cutting blade of any of the nozzles according to Figures 1 to 7;

Fig. 9 illustrates a further embodiment of a cutting blade of the nozzle;

Fig. 10 illustrates still another embodiment of a cutting blade of the nozzle;

Fig. 11 illustrates still another embodiment of a cutting blade of the nozzle;

Fig. 12 illustrates still another embodiment of a cutting blade of the nozzle;

Fig. 13 illustrates still another embodiment of a cutting blade of the nozzle;

Fig. 14 is an explosion view of the embodiment of the nozzle according to Fig. 4, by which the most of constituent parts is also shown in a cross-section in the diametrical plane.

A nozzle according to the invention consists of a housing 1, within which and co-axially to which a nozzle head 2 is attached. The last one is preferably attached to a housing 1 by means of a screw 3.

The housing 1 is available in form of a cartridge and comprises a connecting area 11 and a distributing area 12. The connecting area 11 is intended for connection of the said housing 1 to each available water supply installation 4 (e.g. like those in Fig. 14), and is by this embodiment equipped by an internal screw 110. The distributing area 12 of the said housing 1 is available in form of a transversally arranged wall in the said housing 1, which is equipped by a set of openings 121 extend essentially in the longitudinal direction and are arranged in mutual along the circumference of the said housing 1. In the middle of the said plurality of circularly arranged openings 121, there is arranged a further screwed bore 122 in the distributing area 12, which serves for inserting the screw 3. By this embodiment, a distributing protrusion 124 in form of a coaxially symmetric paraboloid of revolution is available around the said bore 122, which is arranged on a surface 123 of the distributing area 12 and is faced towards the attaching area 11 of the housing 1, in order to enable better distribution and directing the supplied water flow towards the belonging openings 121. The opposite surface 125 of the distributing area 12, which is faced towards the nozzle-head 2 and the screw 3, is of convex shape and is by this embodiment formed as a groove having essentially semi-circular profile and extending circularly around the said bore 122 and in the said openings 121. A front surface 125 of the distributing area 12 of the housing 1, which is faced towards the nozzle-head 2 and the screw 3, is inclined on its both sides, i.e. inwardly and outwardly, so that an internally arranged concave surface 1251 and an externally arranged coned surface 1252 together form an edge 1250,

by which the housing 1 of the nozzle is concluded in the direction towards the nozzle-head 2.

The nozzle-head 2 is commonly available in form of a disc, comprising a longitudinally extending bore 21, which is adapted for receiving a bolt 31 of the screw 3, and is moreover by this embodiment also provided by a cavity 210 adapted for receipt the head 32 of the said screw 3. A front surface 22 of the nozzle-head, which is faced towards the housing 1 of the nozzle, comprises a sharp edge 220, which is formed by means of a conical surface 221 of the outward inclination as well as of a coaxially symmetric arranged concave inner surface 222, which is by this embodiment arranged in such manner, that it extends from the area adjacent to the said bore 21 outwards and across an area of essentially semi-circular profile towards the said edge 220. Diameter of the said edge 220 on the nozzle-head 2 regularly corresponds to the diameter of the said edge 1250, which is available on the housing 1 of the nozzle according to the invention.

Onto the said nozzle-head 2, a cutting assembly 23 can be placed, which consists of a cutting means 230 and positioning means 231, 232. The cutting means 23, which is arranged between these positioning means 231, 232, is available in form of a lamella or a membrane or a thin disc in form of a blade made of a thin metallic sheet or foil having thickness e.g. several tenths of millimeter (several hundreds of μm). The said cutting means 230 commonly comprises at least one cutting edge 2300, which is in the assembled state of the nozzle arranged in the area between each belonging opening 121 of the distributing area 12 of the housing 1 and the front surface 22 of the nozzle-head 2, and simultaneously between both, the edge 1250 of the housing 1 and the edge 220 of the nozzle-head 2, or adjacent to them, respectively. In such position, the said elastic and deformable, essentially a

membrane-like cutting means 230 is held by means of both positioning means 231, 232, which are much more rigid, and is clamped between the said edges 1250 and 220 in order to press the said cutting means 230 being clamped there-between.

By this particular embodiment, six openings 121 are arranged in the distributing area 12 of the housing 1, while the cutting means 230 is available in form of a disc or a collar, which consists of an inner circular area 2301, an outward circular area 2302, as well as of six shanks, which extend in radial direction and by means of which the said areas 2301, 2302 are mutually connected. The inner circular area 2301 is adapted for receiving the bolt 31 of the screw 3, so that during operation of the nozzle, the said cutting means 230 is clamped between both positioning means 231, 232 and is simultaneously held by means of the screw 3 in a fixed position co-axially with respect to the housing 1 as well as to the nozzle-head 2. Quite similarly, the positioning means 231, 232 may also consist of two coaxially arranged circular areas and shanks, which extend in radial direction and which are in the drawing not separately shown. In such manner, six passages are available in the area of the said positioning means 231, 232 as well as of a cutting means 230. It should be clear to those skilled in the art, that appropriate means might also be foreseen, which should prevent the cutting means 230 and the positioning means 231, 232 from rotation thereof around the screw 3; said means are also not shown in connection with this embodiment in the accompanied drawing, but are visible in the Figs. 8 to 13.

When the nozzle is functioning, the nozzle-head 2 is attached to the housing 1 by means of the screw 3, while the cutting means 230 is clamped between the positioning means 231, 232 and together with them by means of the said screw 3 pressed between the housing 1 and the nozzle-head 2 or more exactly between the

edge 1250 available on the housing 1 and the edge 220 available on the nozzle-head 2. The nozzle itself is by means of its connecting area 11 of the housing 1 connected to appropriate installation for supplying a water flow under the pressure of e.g. approx. fifty bar. Between the cutting means 230 and the adjacent positioning means 231, 232 there is a passage, which is quite thin and may be adjusted in appropriate manner by means of the screw 3, which is of a great importance with respect to operation of the nozzle. Water, which enters the nozzle in the connecting area 11, then flows into the distributing area 12, where it is equally distributed towards the openings 121. After passing through the said openings 121, water is distributed within at least approximately toroidal area, which is in the assembled state of the nozzle formed between the housing 1 and the nozzle-head 2 in the area of the positioning means 231, 232, and the cutting means 230. Thanks to the pressure of the water flow on the one hand, as well as to the passage, which is available between the cutting means 230 and the positioning means 231, 232 on the other hand, the water flow is then cut or broken into extremely small drops which form a fog. Dimension of drops directly depends on thickness of the passage available in adjacency of the said cutting means 230, and may be commonly adjusted in advance, or adapted to each desired operation mode of the nozzle.

Direction and shape of the out-flowing fog may be determined by means of appropriate technical concept and the shape of the said at least approximately toroidal cavity between the housing 1 and the nozzle-head 2 in the area of placing the cutting means 230 as well as the positioning means 230, 231, which means especially thanks to the shape of the surface 125 in the area of passages 121 together with the belonging conically inclined surface 1251 as available in the distributing area 12 of the housing 2, as well as to the opposite front surface 222 of

the nozzle-head 2. By this embodiment, thanks to previously described concept and shape of the surfaces 1251 and 222, the fog is flowing out in a geometrically correct form of a paraboloid of revolution with essentially flat top surface, which is e.g. extremely desired by fire extinguishing.

In a further embodiment of the nozzle, as shown in Figs. 4 - 7, in parallel to the said cutting assembly 23, a supplemental cutting assembly 5 is foreseen, which enables still further minimizing and distribution of water drops contained in the fog which is leaving the main cutting assembly 23.

This supplemental cutting assembly 5 comprises at least one cutting means 51, which is arranged transversally with respect to the longitudinal axis of the nozzle, i.e. essentially in the plane of the main cutting means 230. At the same time, this supplemental cutting assembly 5 is arranged outside of the nozzle-head 2, namely on a certain distance from the outer circumferential surface thereof, and simultaneously also on a certain distance from the outer circumferential surface of the adjacent distributing area 12 of the housing 1 of the nozzle. In the illustrated embodiment, the supplemental cutting assembly 5 is made of a thin collar of a broken-through circular shape, and is by this particular embodiment held in desired position by means of several positioning means 52, which protrude in radial direction outwards from the nozzle-head 2, and which are equidistantly arranged along the circumferential surface of the nozzle-head 2. Depending on the construction concept of the said supplemental cutting assembly 5 (and moreover also on the used main cutting means 230) the nozzle according to the invention may form a flow of fog, the shape of which corresponds to a relatively opened, either axially symmetrical or asymmetrical paraboloid of revolution with a flat top surface.

Furthermore, various embodiments of the cutting means 230 of the main cutting assembly 23 are shown on the Figs 8 to 13, which enable forming appropriate flow of the fog in the shape of either axially symmetrical or asymmetrical (Fig. 10) paraboloid of revolution. The cutting means 230 according to Fig. 8 is axially symmetric and is equipped with a plurality of cutouts 234 in circumferential arrangement. The cutting means 230 according to Fig. 9 is also axially symmetric and is equipped with a set of cutouts 234 in circumferentially equidistant arrangement, and moreover also with a set of openings 233 in circumferentially equidistant arrangement. The cutting means 230 according to Fig. 10 is axially asymmetric and is equipped with a set of cutouts 234 of various shape and size, but also at least essentially in circumferential arrangement. The cutting means 230 according to Fig. 11 is also axially symmetric and is equipped with a set of cutouts 234 in circumferentially equidistant arrangement, the shape of which differs from those as shown in the Fig. 9, and moreover also with a set of openings 233 in circumferentially equidistant arrangement. The cutting means 230 according to Fig. 12 is an axially symmetric disc or collar, consisting of an inner circular area 2301 and of an outer circular area 2302, as well as of six essentially arrow-shaped shanks 2303, which extend in radial direction and by means of which the said circular areas 2301, 2302 are mutually connected. The cutting means 230 according to Fig. 13 is also axially symmetric and is equipped with a set of cutouts 234 in circumferentially equidistant arrangement, the shape of which is different as by those shown in Figs. 9 and 11, and moreover also with a set of openings 233 in circumferentially equidistant arrangement.

It is therefore obvious, that the described nozzle offers certain benefits by essentially small number of the constituent parts, which means that also maintenance thereof is essentially simplified, and in addition, that the risk of any

defects which might occur on various constituent parts, may herewith be essentially reduced.

Dimensions of the cross-sections of the openings 121 may be relatively large, which means that the permitted water flow may be essentially greater like e.g. by any other nozzle for forming fog which were known before. Any undesired particle, which would enter the interior of the nozzle e.g. by the water flow, may disturb functioning the nozzle exclusively on the small area on the circumference of the cutting means 230, and cannot hinder operation of the nozzle as such. Any stuffing or similar irregularities in functioning the nozzle might only appear successively, never suddenly, so that timely identification of any irregularities is always possible in order to take appropriate measures in time. Since the water is flowing through a circular passage, the stuffing as a consequence of calc or any other waste is also reduced; and if the stuffing would occur, it would again be of quite local nature and could not disturb functioning of the nozzle as a whole. All these characteristics reflect in an extremely reliable functioning, which is of great and essential importance especially in field of fire extinguishing. Accordingly, the nozzle according to the invention may be used by fire extinguishing in large areas, in groups or in sets even in tunnels, mines, aircrafts or any other transporting means as well as on the or drilling platforms or in any in similar difficult situation with respect to fire extinguishing. At the same time, the hydraulic lost by such nozzles is quite low.

PATENT CLAIMS

1. Nozzle, especially for formation of fog, where the nozzle consists of a housing (1) as well as of a nozzle-head (2), which are arranged coaxially and adjacent each to another, whereby the said head (2) is attached to the said housing (1) by means of a screw (3), and by which the housing (1) comprises a connecting area (11), which is intended for connection of the nozzle to each corresponding water supply installation and is for this purpose equipped with appropriate thread (110), the nozzle is characterized by comprising at least one transversally extending cutting means (230) formed like a thin elastic membrane or collar and belonging to a cutting assembly (23), which is placed between the housing (1) and the nozzle-head (2), which are arranged co-axially each to another and pressed one against to another.

2. Nozzle according to Claim 1, characterized by comprising at least one supplemental cutting assembly (5) in parallel to the main cutting assembly (23), by which the cutting means (51) of the supplemental cutting assembly is placed at least essentially in the plane of the cutting means (230) of the main cutting assembly (23), however outside of the nozzle-head (2).

3. Nozzle according to Claim 1 and/or 2, characterized by comprising at least one cutting assembly (23), which comprises at least one at least essentially circular cutting means (230) formed like a thin elastic membrane or collar, and which is placed co-axially between the housing (1) and the nozzle-head (2), which are arranged co-axially each to another and pressed one against to another.

4. Nozzle according to Claim 3, characterized by that between the housing (1) and the nozzle-head (2), which are co-axially aligned and pressed one against another by means of a screw (3), a cutting assembly (23) is clamped, which is also arranged co-axially with respect to the said housing (1) and the nozzle-head (2), and which comprises at least one at least essentially circular cutting means (230), which is clamped between two positioning means (231, 232), which together with the said cutting means (230) surround the bolt (31) of the said crew (3).

5. Nozzle according to any of the Claims 1 to 4, characterized by that the housing (1) consists of the connecting area (11) and a distributing area (12), where the connecting area (11) is equipped with a thread (110), and the distributing area (12) is equipped with a set of longitudinal holes (121) in equidistant arrangement in the circumferential direction of the nozzle.

6. Nozzle according to Claim 5, characterized by that the distributing area (12) of the housing (1) is equipped, on the side facing towards the nozzle-head (2) and in the area of the said openings (121), with a bore (122) intended for inserting the bolt (31) of the screw (3), and on the opposite side, it is equipped with a centrally arranged convex distributing surface (124) in form of paraboloid.

7. Nozzle according to Claim 7, characterized by that the distributing area (12) of the housing (1) is equipped with a concave circumferential extending surface (1251), which is arranged in the area of the openings (121) and on which a sharp circumferentially extending edge is available, which is formed by the said surface (1251) together with the outer conical surface (1252).

8. Nozzle according to any of the Claims 1 to 4, characterized by that the nozzle-head (2) comprises a sharp circumferential edge (220), which is arranged on the side, which faces towards the housing (1).

9. Nozzle according to Claim 8, characterized by that the nozzle-head (2), which is equipped by a centrally arranged bore (21) for inserting the bolt (31) of the screw (3), on its side which is facing towards the housing (1), is also equipped with a sharp circumferential edge (220), which is formed by a concave front surface (22) and a conically inclined circumferential surface (221).

10. Nozzle according to Claim 9, characterized by that the centrally arranged bore (21), which is foreseen for inserting the bolt (31) of the screw (3), is also equipped with a cavity (210), which is adapted for receiving a head (32) of the screw (3).

11. Nozzle according to Claim 9, characterized by that the nozzle-head (2) having a centrally arranged bore (21) intended for inserting the bolt (31) of the screw (3), is equipped on its side facing towards the housing (1) with a sharp circumferential edge (220), which is formed by a conical inclined outer circumferential surface (221) and a concave front surface (22) consisting of a rounded area arranged adjacent to the bore (21) as well as of a conical area abutting the said rounded area.

12. Nozzle according to any of the Claims 1 to 4, characterized by that between the edge (1250) available on the housing (1), and the edge (220) available on the nozzle-head (2), a cutting assembly (23) is clamped by means of the screw (3), which extends through the nozzle-head (2) and is screwed into the housing (1), by

which the said cutting assembly (23) consists of at least two positioning means (231, 232), which are arranged in contact with the belonging edges (1250, 220) and between which at least one cutting means (230) is placed, which is relatively thin and formed like a membrane.

13. Nozzle according to Claim 12, characterized by that the cutting means (230) of the cutting assembly (23) consists of an inner circular area (2301) and an outer circular area (2302), which are mutually connected by means of a plurality of shanks (2303), which extend in radial direction and are preferably formed in equidistant arrangement in the circumferential direction.

14. Nozzle according to Claim 12, characterized by that each positioning means (231, 232) is formed similarly as the cutting means (230), namely comprising an inner circular area and an outer circular area, which are mutually connected by means of several shanks extending in radial direction.

15. Nozzle according to Claim 12, characterized by that between the coaxially arranged and one against another pressed housing (1) and nozzle-head (2) a cutting assembly (23) is clamped, which is arranged coaxially with respect to the said housing (1) and the said nozzle-head (2) and which comprises at least one at least approximately circular, coaxial and in the transversal plane of the nozzle arranged cutting means (230), and that the distributing area (12) of the housing (1) is equipped by several longitudinally extending openings (121) surrounding a bore (122) adapted for inserting a bolt (31) of the screw (3), and that on the front surface (125) of the housing (1) a sharp circumferentially extending edge (1250) is foreseen, while the surface (1251) facing towards the nozzle-head (2) is sloped in the area of the said openings (121) and forms the said edge (1250) together with

the outer conical surface (1252), and that in addition the nozzle-head (2), which is equipped with a bore (21) for inserting a screw (3) and preferably also with a cavity (210) for inserting the head (32) of the screw (3), on its side faced towards the housing (1) is equipped with a sharp circumferentially extending edge (220), which is formed by an outer conical inclination (221) and a concave area (222) of the front surface (22), and that the cutting assembly (23) which is clamped between the nozzle-head (2) and the housing (1), comprises at least one cutting means (230), which is available as a thin elastic membrane and is by means of the said screw (3) clamped between the said sharp edges (1250, 220) available on the housing (1) respectively on the nozzle-head (2).

16. Nozzle according to Claim 2, characterized by that the supplemental cutting assembly (5) comprises at least one supplemental cutting means (51) which is arranged outside of the nozzle-head (2) and the housing (1), and which has at least approximately circular shape and is arranged outside of the nozzle-head (2) and the housing (1) at least approximately within the plane of the main cutting assembly (23) as available between the housing (1) and the nozzle-head (2), i.e. transversally with respect to the longitudinal axis of the nozzle.

17. Nozzle according to Claim 16, characterized by that the supplemental cutting means (51) is held in position by means of positioning means (52) protruding in radial direction outwards from the nozzle-head (2).

18. Nozzle according to Claim 17, characterized by that the supplemental cutting means (51) is held in position by means of positioning means (52), which protrude in radial direction outwards from the nozzle-head (2) and are available in equidistant arrangement in circumferential direction.

19. Nozzle according to any of the Claims 1 to 12 and 14 to 18, characterized by that, the main cutting means (230) is equipped with a set of openings (233) arranged in equidistance in the circumferential direction.

20. Nozzle according to any of the Claims 1 to 12 and 14 to 18, characterized by that, the main cutting means (230) is equipped with a set of cutouts (234) arranged in equidistance in the circumferential direction.

21. Nozzle according to any of the Claims 1 to 12 and 14 to 18, characterized by that, the main cutting means (230) is equipped with a set of openings (233) and cutouts (234) arranged in equidistance in the circumferential direction.

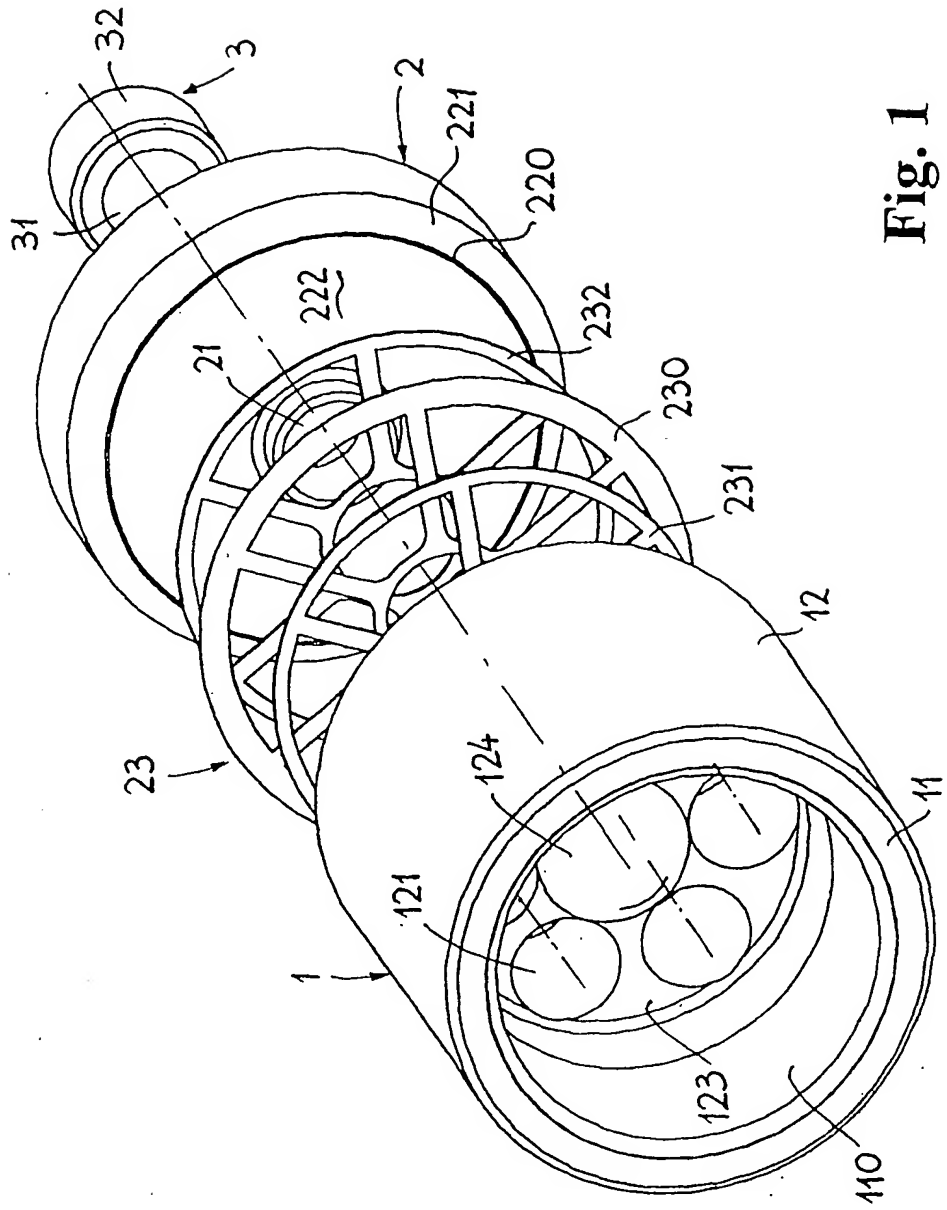
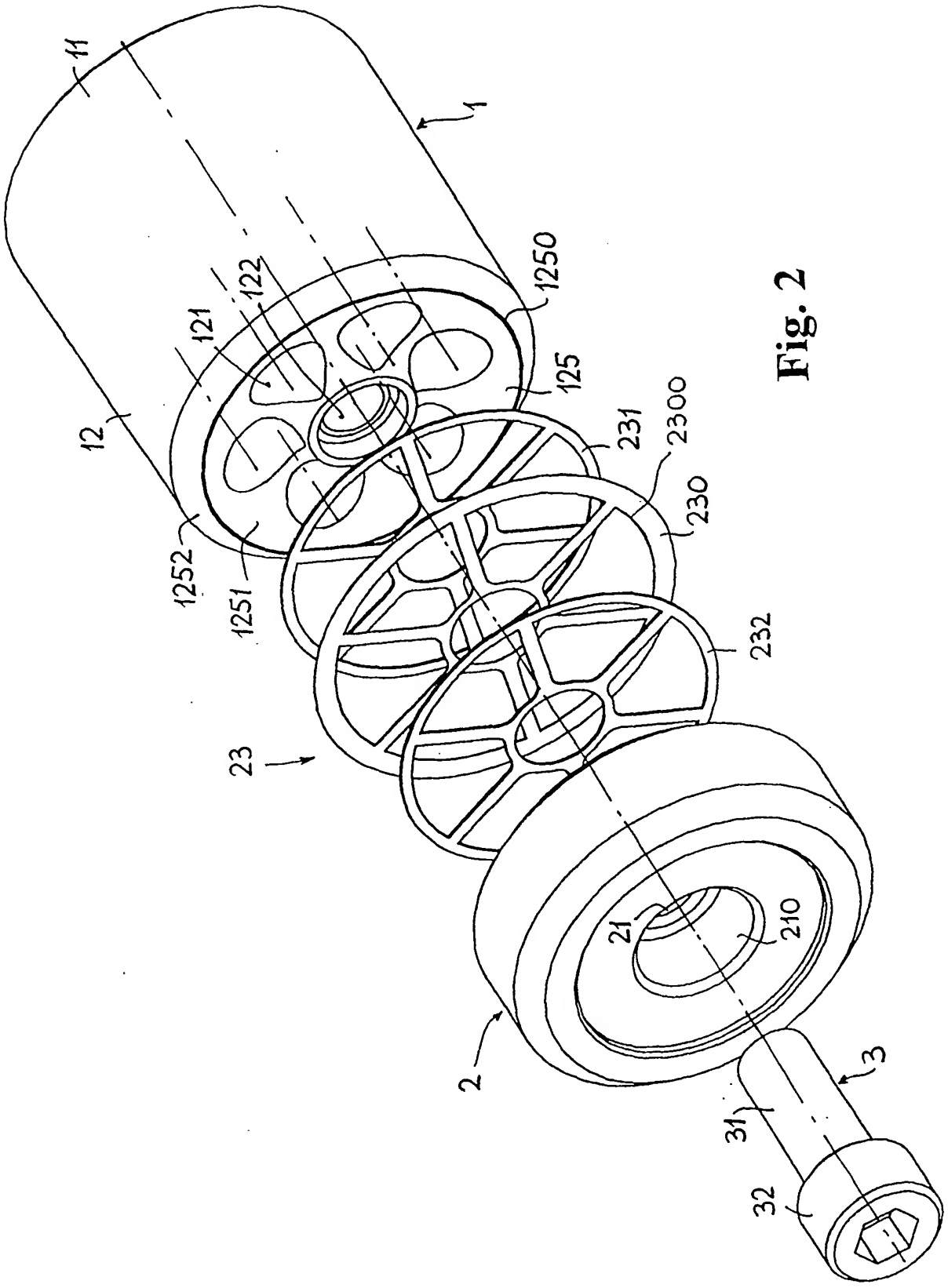


Fig. 1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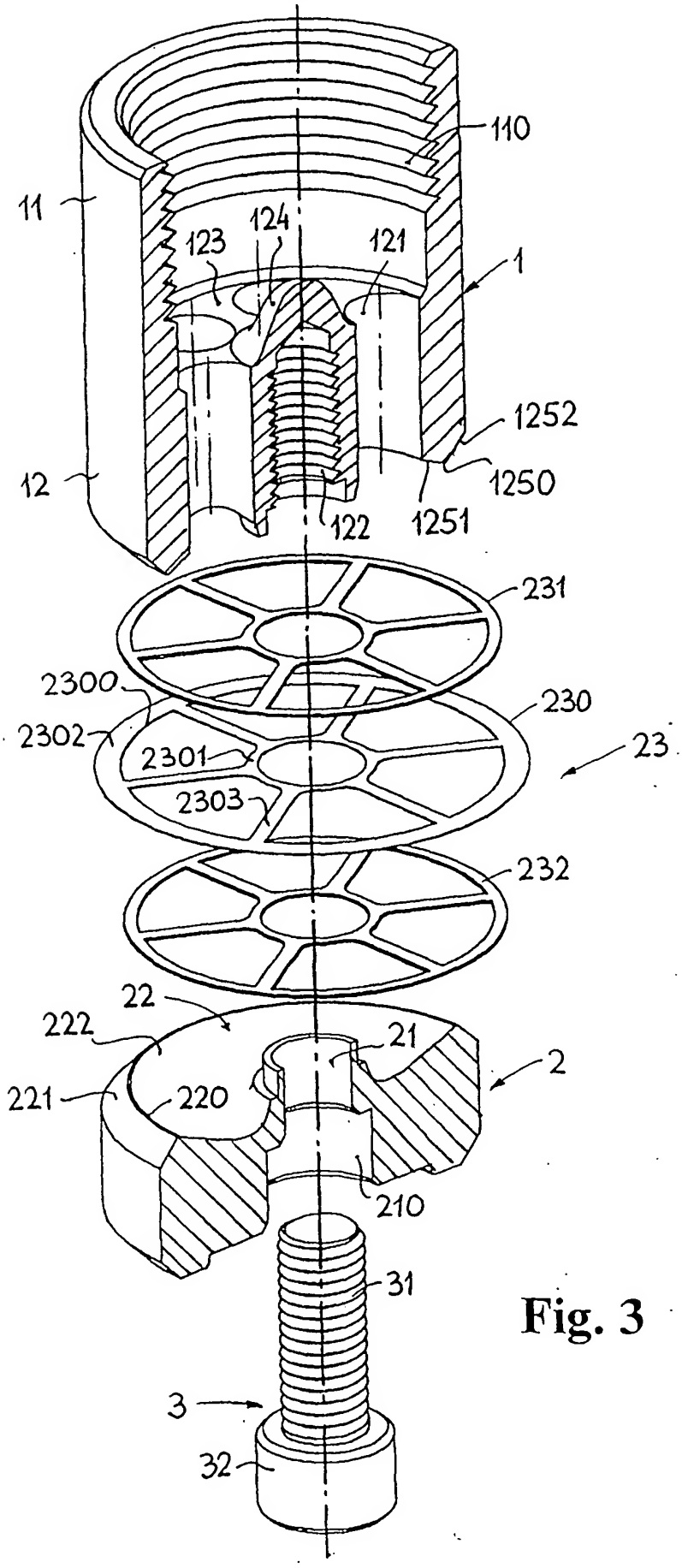
1
1250
122
121
125
12
231
2300
230
1252
1251
232
23
21
210
2
3
31
32

Fig. 2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123
124
121
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1252
12
1250
122
1251
231
2300
230
2302
2301
23
2303
232
22
222
21
2
221
220
210
31
3
32

Fig. 3

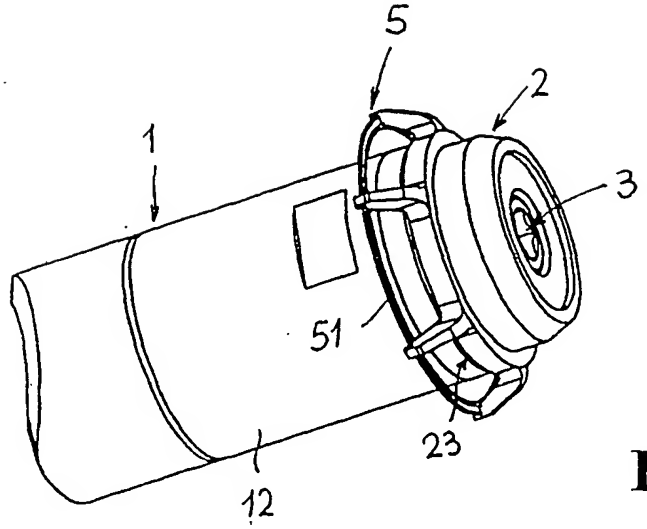

Fig. 4

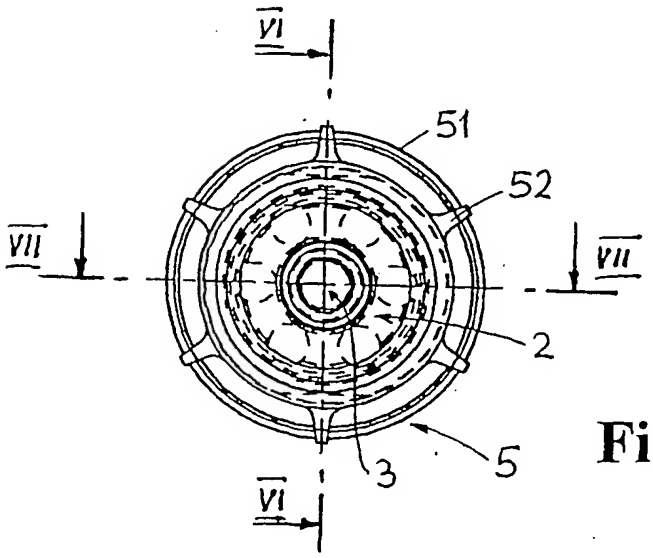

Fig. 5

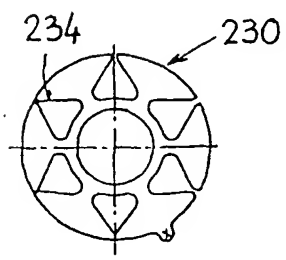

Fig. 8

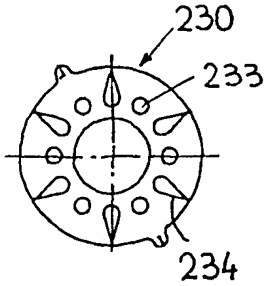

Fig. 9

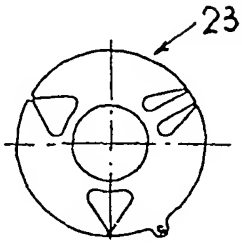

Fig. 10

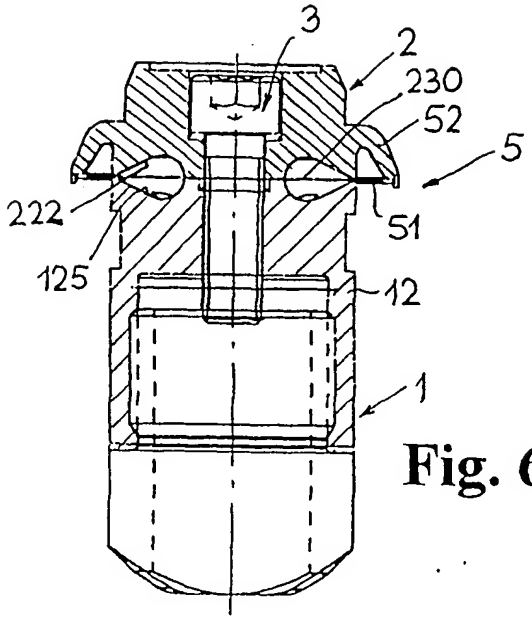

Fig. 6

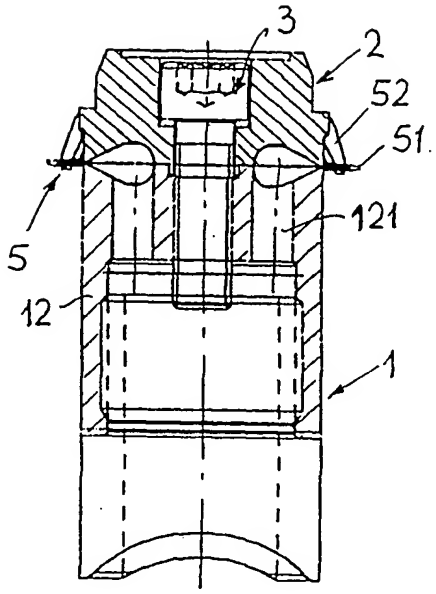

Fig. 7

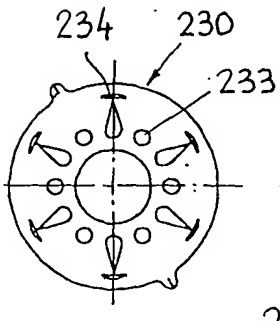

Fig. 11

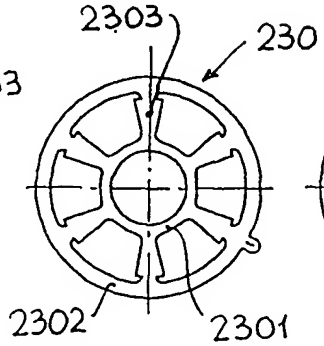

Fig. 12

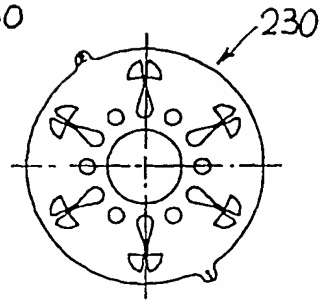

Fig. 13

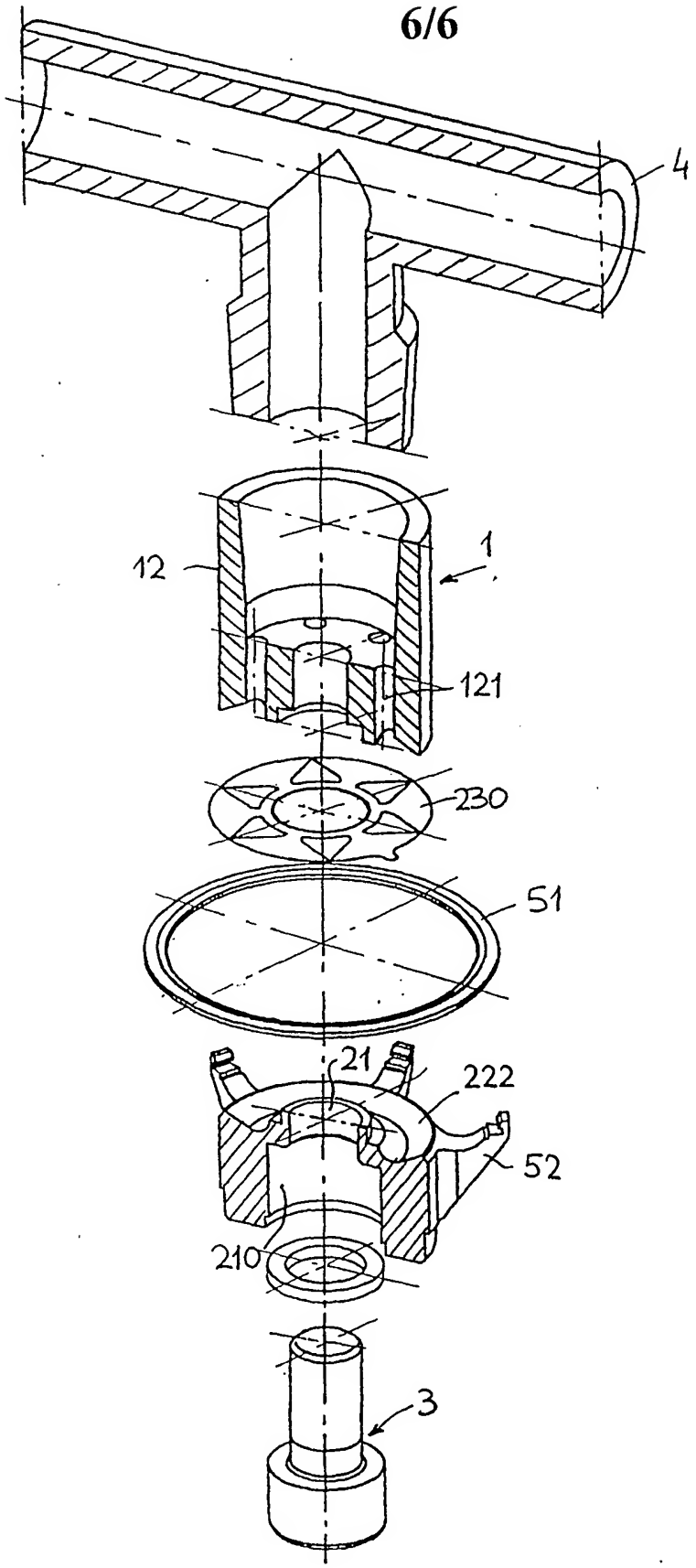

Fig. 14

INTERNATIONAL SEARCH REPORT

national Application No
PCT/SI 01/00036

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05B1/26 A62C31/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B05B A62C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 120 957 A (MATSUSHITA ELECTRIC IND CO LTD) 14 December 1983 (1983-12-14) page 1, line 92 - line 106; figures	1,3,4,8, 19-21
A	US 2 224 450 A (SCOFIELD PHILIP F) 10 December 1940 (1940-12-10) page 2, left-hand column, line 5 - line 19; figures	1
A	EP 0 518 579 A (CURTIS HAROLD D) 16 December 1992 (1992-12-16) column 3, line 36 -column 4, line 46; figures	1
A	US 4 568 025 A (MCLOUD DONALD H) 4 February 1986 (1986-02-04) column 3, line 10 - line 17; figure 1	1

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 April 2002	18/04/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Brévier, F

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
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A	DE 78 08 288 U (SULZER-ESCHER WYSS GMBH) 10 November 1988 (1988-11-10) page 5, paragraph 2 page 6, paragraph 1; figures	5,6
A	US 3 462 085 A (NUGARUS ANTHONY R) 19 August 1969 (1969-08-19) column 3, line 62 - line 66; figure 1	10

INTERNATIONAL SEARCH REPORT

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